CLAIMS

We claim:

1. A system for generation and storage of pressurized hydrogen gas, comprising:

(a) a hydrogen gas generator which comprises:

a first compartment comprising at least one chemical hydride; and

(b) a hydrogen storage canister in fluid communication with the hydrogen generator.

2. The system of claim 1, further comprising at least one hydrogen conditioner in fluid communication with the hydrogen gas generator and the hydrogen storage canister.

3. The system of claim 2, wherein the hydrogen conditioner is selected from the group consisting of a condenser, a drier, a purifier and combinations of any two or more thereof.

4. The system of claim 3, wherein the hydrogen conditioner comprises a vessel which contains one or more desiccant materials.

5. The system of claim 4, wherein the one or more desiccant materials are selected from the group consisting of zeolites, molecular sieve adsorbents, activated carbon adsorbents, activated alumina adsorbents, silica, CaS, $CaCl_2$, $Ca(SO_4)_2$ and mixtures of any two or more of the foregoing.

6. The apparatus of claim 1, wherein the chemical hydride is selected from the group consisting of sodium borohydride, lithium borohydride, sodium aluminum hydride, lithium aluminum hydride, lithium hydride, sodium hydride, calcium hydride, magnesium hydride, aluminum metal, magnesium metal, magnesium/iron alloys and mixtures of any two or more of the foregoing.

7. The system of claim 1, wherein the at least one chemical hydride is in the form of a solid.

8. The system of claim 7, wherein the hydrogen gas generator further comprises a second compartment comprising an aqueous solution.

9. The system of claim 8, wherein the first and second compartments are disposed within a single container, and wherein the first compartment is in selective fluid communication with the second compartment.

10. The system of claim 8, wherein the aqueous solution in the second compartment is at a pressure greater than the pressure of the first compartment.

11. The system of claim 8, wherein the hydrogen gas generator further comprises at least one promoter.

12. The system of claim 8, wherein the hydrogen gas generator is capable of generating hydrogen gas having a pressure sufficient to fill a hydrogen storage canister.

13. The system of claim 8, wherein the hydrogen gas generator is capable of generating hydrogen gas having a pressure of at least about 50 psig.

14. The system of claim 8, wherein the hydrogen storage canister comprises at least one metal hydride represented by the formula AB.

15. The system of claim 8, wherein the hydrogen storage canister comprises at least one metal hydride of a type selected from the group consisting of AB_2 and AB_5.

16. The system of claim 8, further comprising a heat exchanger in thermal communication with the hydrogen storage canister.

17. The system of claim 8, wherein the first compartment is disposed in a first container and the second compartment is disposed in a second container, and wherein the first container is in selective fluid communication with the second container.

18. The system of claim 1, wherein at least a portion of the at least one chemical hydride is in the form of a solution.

19. The system of claim 18, wherein the solution is selected from an aqueous solution and ammonia.

20. The system of claim 19, wherein the hydrogen gas generator further comprises at least one promoter.

21. The system of claim 20, wherein the at least one promoter is in selective fluid communication with the aqueous solution.

22. The system of claim 20, wherein the hydrogen gas generator further comprises a second compartment comprising at least one promoter.

23. The system of claim 22, wherein the first and second compartments are disposed within a single container, and wherein the first compartment is in selective fluid communication with the second compartment.

24. The system of claim 19, wherein the hydrogen gas generator is capable of generating hydrogen gas having a pressure sufficient to fill a hydrogen storage canister.

25. The system of claim 19, wherein the hydrogen gas generator is capable of generating hydrogen gas having a pressure of at least about 50 psig.

26. The system of claim 19, wherein the hydrogen storage canister comprises at least one metal hydride of a type selected from the group consisting of AB, AB_2 and AB_5.

27. The system of claim 26, wherein at least one metal hydride is selected from the group consisting of TiFe, $Ti_{0.98}Zr_{0.02}V_{0.43}Fe_{0.09}Cr_{0.05}Mn_{1.5}$ and $MmNi_5$, wherein Mm is a mischmetal.

28. The system of claim 19, further comprising at least one hydrogen conditioner, and wherein the hydrogen conditioner is selected from the group consisting of a condenser, a drier, a purifier and combinations of any two or more thereof.

29. The system of claim 28, wherein the hydrogen conditioner comprises a vessel which contains one or more desiccant materials.

30. The system of claim 29, wherein the one or more desiccant materials are selected from the group consisting of zeolites, molecular sieve adsorbents, activated carbon adsorbents, activated alumina adsorbents, silica, CaS, $CaCl_2$, $Ca(SO_4)_2$ and mixtures of any two or more of the foregoing.

31. The system of claim 19, further comprising a heat exchanger in thermal communication with the hydrogen storage canister.

32. The system of claim 22, wherein the first and compartment is disposed in a first container and the second compartment is disposed in a second container, and wherein the first container is in selective fluid communication with the second container.

33. A method for generating and storing pressurized hydrogen gas, comprising the steps of:

(a) irreversibly generating pressurized hydrogen gas by a chemical reaction of at least one chemical hydride; and

(b) collecting and storing the pressurized hydrogen gas in a hydrogen storage canister.

34. The method of claim 33, further comprising passing the pressurized hydrogen gas formed in step (a) through a hydrogen conditioner prior to collecting and storing the pressurized hydrogen gas in a hydrogen storage canister.

35. The method of claim 33, wherein the at least one chemical hydride is in the form of a solid.

36. The method of claim 35, wherein the generating step comprises contacting at last one chemical hydride with a material selected from the group consisting of an aqueous solution and ammonia.

37. The method of claim 35 wherein the generating step comprises heating the at last one chemical hydride.

38. The method of claim 35, wherein the generating step further comprises contacting at last one chemical hydride with a promoter.

39. The method of claim 33, wherein at least a portion of the at least one chemical hydride is in the form of a solution.

40. The method of claim 39 wherein the solution is an aqueous solution.

41. The method of claim 39, wherein the generating step comprises contacting at last one chemical hydride with a promoter.